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Specification

Heat-sealing device

Technical field

This invention relates to the device which heat-heals the tube shape packaging material fabricated from the packaging material web in the transversal direction, and the filling machine which manufactures the packaging container filled up with fluid food, and has this heat-sealing device.

Background art

A filled packaging container is used for milk, a fruits drink, etc., and, generally is made from laminated packaging material.
Packaging material has the comparatively rigid main supporting layer covered with the thin layers of plastic materials.
This material can also contain the material of aluminum foil or others.
The common feature of this type of all packaging laminated material is that the thermoplastic material (usually polyethylene) layer provided an outside and inside laminated material seals two portions of the laminated material which countered to each other in the liquid tight state with heat and pressure.
In order for a seal to have desired strength and a desired liquid tight performance, both two thermoplastic layers to seal are surely clean, and it is required not to include impurities.
In such case of the clean layer, sufficient melting of each thermoplastic layer can be obtained and, as a result, the optimum seal is brought by strong high sealing performance.
Since the impurities of the thin oxide formed on packaging laminated material during extrusion steps of thermoplastic layers usually exist in a thermoplastic layer, the perfect melting between thermoplastic layers is alike occasionally, and is blocked
Therefore, a seal cannot acquire possible strength and possible sealing performance.
Moreover, when sealing packaging materials under the surface of liquid food, the impurity of the residual substance of the content (liquid food) which hinders the sealing further may also be generated on the surface of a thermoplastic layer.
This is a problem peculiar to the packaging filling system that the seal of laminated material is performed under the liquid surface of liquid foods.
That is, in this packaging filling, the content food must be first pushed out from the crevice

between the surfaces of thermoplastic materials before sealing.
However, as a practical question, the residual substance of very small quantity remains, without squeezing out content food completely, and this residual substance weakens the seal.

Disclosure of the invention

The purpose of this invention is offering the device which can heat-heal the above-mentioned packaging laminated material so that all the above-mentioned problems may be avoided, having the optimum seal performance.
The further purpose of this invention is offering the device which heat-heals the packaging laminated material which can lose the bad influence of such a seal prevention impurity as much as possible, and makes the optimum seal possible, even if packaging laminated material is covered with an oxide, the residual substance of a packaging content, or impurities.
The above-mentioned subject is solved by the heat-sealing device according to this invention.
The heat-sealing device heat-heals a tube shape packaging material in the transversal direction under the surface of liquid food. Tube shape packaging material is packaging material with which it is formed by the tube shape from a packaging material web, and liquid food is filled up in this tube.
The device pushes this tube from its outside by the seal jaw and the counter jaw, and heat-heal the tube in the transversal direction of the tube. The device heat-heals the seal zone of the packaging material containing a cutting predetermined zone under the surface of liquid food.
The operation surface of the seal jaw in contact with the seal zone has a substantially flat surface.
The operation surface of the counter jaw is characterized by having removal/mixture means.
The removal/mixture means removes the seal prevention impurity which may remain in the tube of a seal zone from this seal zone, and/or mixes the impurity with the melted or softened packaging material in the seal zone.
In the preferable embodiment of this invention, removal/mixture means may be the slope provided in the operation surface of the counter jaw.
In the preferable embodiment of this invention, removal/mixture means may be the slope of a cross-sectional chevron-shape provided in the operation surface of the counter jaw.
In a preferable embodiment of this invention, removal/mixture means can be ridges continuously or discontinuously provided in the operation surface of the counter jaw.

In the preferable embodiment of this invention, the inductor for forming a seal zone by the high frequency induction heating may be arranged in the seal jaw, and the packaging material may comprise a metal thin layer and a thermoplastic material innermost layer.
In the preferable embodiment of this invention, the horn for forming a seal zone by ultrasonic heating may be arranged in the seal jaw, and the packaging material may comprise at least a thermoplastic material innermost layer.
In the preferable embodiment of this invention, electrical - resistor for forming a seal zone by heating is provided in the seal jaw, and packaging material may have at least a thermoplastic material innermost layer.
The filling machine by this invention forms a packaging material web to a tube shape, fills up with liquid food in the tube, heat-heals and cuts the tube shape packaging material in the transversal direction. The filling machine by this invention is characterized by having the heat-sealing device by this above-mentioned invention.

Brief description of the accompanying drawings

Fig. 1 is a sectional view showing the structure and operation of the heat-sealing device of the 1st example by this invention.
Fig. 2 is a sectional view of the packaging material used for the heat-sealing device of this invention.
Fig. 3 is an outline figure showing the structure and operation of the filling machine equipped with the heat-sealing device by this invention.
Fig. 4 is a sectional view showing the structure and operation of the heat-sealing device of the 2nd example by this invention.
Fig. 5 is a sectional view showing the structure and operation of the heat-sealing device of the 3rd example by this invention.
Fig. 6 is a sectional view showing the structure and operation of the heat-sealing device of the 4th example by this invention.
Fig. 7 is a sectional view showing the structure of the counter jaw of the heat-sealing device of the 5th example by this invention.
Fig. 8 is a sectional view showing the structure of the counter jaw of the heat-sealing device of the 6th example by this invention.

Detailed description of the invention

Hereafter, although the examples about the heat-sealing device according to this invention are described based on the drawings, this invention is not limited to the examples indicated

by these drawings.

The outline of an example of the filling machine equipped with the heat-sealing device by this invention is shown in Fig. 3.

The filling machine shown in this example is operated as follows.

From a roll, a filling machine unwinds the packaging material web 1 which comprises a thermoplastic material layer in an innermost layer, and conveys the inside of the filling machine with rollers.

The filling machine seals the strip tape 2 to the end of the packaging material web by the strip tape applicator 3, and sterilizes the packaging material web which passes through the inside of the sterilization agent bath 4.

The filling machine removes the sterilization agent with an air-knife 5, and forms it to a tube shape with forming rollers 6.

It fills up with liquid food from a filling pipe 7 in the tube, and seals a longitudinal seal element 8 in the direction of longitudinal in the tube. Sending this tube below by the length equivalent to one packaging container, the tube is pushed by seal jaws 10 and counter jaws 11 of heat-sealing device of this invention, and the filling machine heat-heals the tube in the transversal direction, and forms it continuously in the pillow-shaped packaging container 12 simultaneously.

Then, a cutting predetermined zone of the seal zone of the pillow-shaped packaging container is cut, and the filling machine separates with a knife in each packaging container 13, and flaps of the upper and lower sides of the separated container 14 are folded, and forms the packaging container 11 having a final shape with a final holder 14.

An example of the packaging material 1 which can be used in this invention is shown in Fig. 2.

This packaging material has the shown layer structure, and consists of a thermoplastic material layer 31 of an outermost layer, a paper layer 32, a metal layer 33 that is an oxygen barrier layer, and a thermoplastic material layer 34 of an innermost layer.

The packaging material in this invention is not limited to the above-mentioned example, but various packaging material can be used for it. For example, a packaging laminate contains low-density polyethylene (LDPE) / printing ink layer / paper (fibrous) substrate layer / LDPE / aluminum foil / LDPE/LDPE, LDPE / printing ink layer / paper substrate layer / LDPE/LDPE, printing ink layer / LDPE / paper substrate layer / LDPE/LDPE and LDPE / a printing ink layer / paper substrate layer / LDPE / aluminum / polyester (PET).

Moreover, the ethylene alpha olefin copolymer (the so-called metallocene PE) which polymerized using the single site catalyst can also be used for an innermost layer or/, and the outermost layer in addition to LDPE of the above.

Furthermore, the vapor deposited layer of an inorganic oxide can also be used as a

practical substitute which substitutes for the metal layer (aluminum foil) of the above-mentioned oxygen barrier layer.

Fig. 1 shows the seal device by this invention in section with the heat-healed packaging material 1.

The main part of the seal jaw 10 is made from an un-conductive material, and contains the cylindrical inductor 101 of a conductive material, for example, copper.

The inductor 101 located in the center of the operation surface of a main part forms the operation surface 102 of the seal jaw 10 with the circumference portion of the main part. The formed operation surface is a substantially flat surface. This inductor 101 is arranged in order to form the seal zone in the seal jaw 10 by the high frequency induction heating.

The packaging material in this case is a laminate which comprises the metal thin layer and the thermoplastic material innermost layer.

In this high frequency induction heating, a magnetic field occurs around the coil which connects with a high frequency power supply and passes high frequency current, an eddy current arises in the metal foil of the coil circumference, and the Joule heat is generated by this eddy current and the resistance of metal foil (layer).

The generated Joule heat is transmitted to the thermoplastic material innermost layer which faced the metal (foil) layer, and melts this thermoplastic material layer.

In this example, an inductor 101 corresponds to a part of coil of the above-mentioned high frequency induction heating. Other portions (not shown) of the coil can be arranged at the reverse side of an inductor 101 or to the exterior of the seal jaw 10 etc.

In this invention, the operation surface 102 of the seal jaw 10 facing the seal zone 20 comprises a substantially flat surface. The operation surface 111 of the counter jaw 11 has the removal/mixture means.

The removal/mixture means removes the seal prevention impurity from the seal zone 20, and mix the impurity with the melting or softening (melting/softening) packaging material in the seal zone 20.

In the case of this example, removal/mixture means is the ridge 111 continuously or discontinuously provided in the operation surface 112 of this counter jaw. The ridge 111 which projects from the operation surface 112 is provided in the counter jaw 11. The cross-sectional shape of this ridge 111 has a mostly rectangle. The height is 0.2 to 0.8 times the thickness of laminated material, preferably 0.5 times.

The width is almost equal to the width of packaging laminated material.

The ridge is not limited to this example, for example, it includes a ridge with a round top, a ridge of a cross-sectional trapezoid, etc.

The operation surface 102 of the seal jaw 10 contains the central zone which heats the laminated material 1. The counter jaw 11 has a ridge 111and the adjoining zones of the

ridge.

In order to enable high frequency welding of the laminated material 1 containing aluminum foil, the high frequency power supply is connected with an inductor 101, which heats laminated material.

When sealing the packaging laminated material which does not contain aluminum foil (metal layer 33) or other conductive layers together, the laminated material heating zone may consist of for example, resistance material.

The seal device by this invention may modify this by various methods within the limits of the concept of this invention, in order to fulfill the necessary condition of the seal of the different packaging containers and materials and.

In this example, the tube of packaging material is sealed in the transversal direction to form a seal zone, and the seal zone is cut by a cutting predetermined zone 21 in the seal zone. A knife (or a certain other suitable cutting devices) operates in the cutting predetermined zone 21.

Moreover, in this example, the eddy current by the oscillating magnetic field is induced in the aluminum (metal) layer 33 of the packaging laminated material 1.

The aluminum (metal) layer 33 is heated at the temperature higher than the melting point of the thermoplastic layer which adjoins in the zone corresponding to the surface of an inductor 101.

The generated heat is directly transmitted to the thermoplastic layer 34 and 34 located between the aluminum layers 33 and 33, melts a thermoplastic layer, and is changed to a fluid.

For the high pressure (approximately 100kg/cm^2) at which a ridge 111 pushes packaging laminated material, the melted thermoplastic material runs and flows to the zones 20 and 20 from the high-pressure zone 21of the seal zone.

The thermoplastic layers 34 and 34 which counter to each other and are located in the zone outside the seal zones 20 and 20 keep solid state, and they are pushed, countering to each other. Without flowing out outside further, the melted thermoplastic material stops in the zone shown by the reference number 20 in the seal zone, and forms the high-pressure zone 21 and the accumulation zones 20 and 20. Two layers mix and seal in an accumulation portion (zones 20 and 20) to each other.

The excess of the plastic well mixed at the accumulation portions (zones) 20 and 20 formed in the seal zone is included, and the seal of practically sufficient strength is obtained between two layers.

Since the flow by the high pressure is very quick, the mixture with a sufficient plastic material from between two layers which counter is guaranteed by the turbulent flow generated into the flowing plastic material.

Therefore, the residual substance of the oxide and the liquid food content which exists in the surface is effectively mixed within a plastic, and the film of the impurities which spoil the strength of the seal does not remain.

The seal device by this invention can be modified by various methods within the limits of the concept of this invention in order to fulfill the necessary condition of the seals of packaging containers.

Although the material of the ridge which is hard to deform by the pressure during the seal step in the above-mentioned example was used, a ridge may be a deformable elastic material. In this case, although the above seal zones 20 (accumulation portion) cannot be significantly formed between laminated packaging materials, a higher pressure can be made from a ridge portion.

The seal prevention impurity which may remain in the seal zone is removed from a seal zone, and in the seal zone, melted or softened packaging material can be mixed.

Fig. 4 illustrating the 2nd example shows the seal steps at the time of sealing two packaging laminated materials 1 and 1 by the example of device by this invention.

Two packaging laminated materials 1 and 1 (or two facing portions of the same folded-up packaging laminated material) are sealed between the thermoplastic layers of those innermost layers. The counter jaw 11 and the seal jaw 10 push packaging laminated materials.

This seal jaw 10 has the flat operation surface 102 like the seal jaw shown in Fig. 1.

On the other hand, the operation surface 112 facing the packaging laminated material 1 is provided in the counter jaw 11, and the slope of a cross-sectional chevron-shape is provided in this operation surface.

When pressuring the packaging laminated materials 1 and 1 by the seal jaw 10 and the counter jaw 11, this slope removes the seal prevention impurity, which may remain in the seal zone, from this seal zone, and a slope mixes the impurity with the packaging material melted or softened in the seal zone.

Although the mechanism is not necessarily clear, since the operation surface inclines, the power of the pressure of packaging laminated material inclines, and when innermost thermoplastic material is still in a solid state, a content residual substance is pushed out by innermost thermoplastic material from the seal zone.

The surface oxide and the content residual substance are pushed out from the seal zone in the softening/melting stage of innermost thermoplastic material, are mixed with the thermoplastic material.

In addition, this mechanism does not limit the scope of this invention.

As shown in the right figure of Fig. 4, two packaging laminated material is sealed by the pressure and heating, the seal zones 20 and 20 containing a cutting predetermined zone

are formed, and, subsequently a knife etc. cuts the cutting predetermined zone 21.

Fig. 5 illustrating the 3rd example shows the seal steps at the time of sealing two packaging laminated materials 1 and 1 by the example of device by this invention.

The thermoplastic innermost layers of two packaging laminated materials 1 and 1 (or two portions of the same folded-up packaging laminated material) counter to each other in order to be sealed.

The packaging laminated materials are pushed by the seal jaw 10 and the counter jaw 11.

The horn for forming a seal zone by ultrasonic heating is arranged in the seal jaw 10, and the seal jaw 10 has the flat operation surface 102.

On the other hand, the operation surface 112 facing the packaging laminated materials 1 and 1 is provided in the counter jaw 11, and the slope of a cross-sectional chevron-shape is provided in this operation surface.

When this slope pressures two packaging laminated material 1 and 1 by the seal jaw 10 and the counter jaw 11, the seal prevention impurity which may remain in a seal zone is removed from the seal zone, and the melting/softening packaging material of the seal zone is mixed with the impurity.

Since the operation surface inclines, the pressure power to packaging laminated material inclines, and when innermost thermoplastic material is still in a solid state, a content residual substance is pushed out from a seal zone by the solid innermost layer.

In the softening/melting stage of innermost thermoplastic material, a surface oxide and a content residual substance are mixed with softening/melting thermoplastic material, and are pushed out from the seal zone.

As shown in the right figure of Fig. 5, two packaging laminated materials are sealed by the pressure and heating, the seal zones 20 and 20 containing a cutting predetermined zone are formed, and, subsequently a knife etc. cuts the cutting predetermined zone 21.

Fig. 6 illustrating the 4th example shows the seal steps of the packaging laminated materials 1 and 1 by the example of device by this invention.

The thermoplastic innermost layers of two packaging laminated materials 1 and 1 (or two portions of the same folded-up packaging laminated material) counter to each other to be sealed.

The packaging laminated materials are pushed by the seal jaw 10 and the counter jaw 11.

The resistance 101 which forms a seal zone 10 by conduction heating is arranged in the seal jaw, and the seal jaw 10 has the flat operation surface 102.

The operation surface 112 which counters the packaging laminated material 1 is provided in the counter jaw 11, and the slope of a cross-sectional straight line shape is provided in the operation surface.

When the slope pushes the packaging laminated materials 1 and 1 by the seal jaw 10 and

the counter jaw 11, the seal prevention impurity which may remain in the seal zone is removed from this seal zone, and the melting/softening packaging material of a seal zone is mixed with the impurity.

Since the operation surface inclines, the pressure power of packaging laminated material inclines, and when innermost thermoplastic material is still in a solid state, a content residual substance is pushed out by the solid innermost layer from the seal zone.

In the softening/melting stage of innermost thermoplastic material, a surface oxide and a content residual substance are mixed with the softening/melting thermoplastic material, and/or are pushed out from the seal zone.

In addition, this mechanism does not limit the scope of this invention.

As shown in the right figure of Fig. 6, packaging laminated material is sealed by the pressure and heating, the seal zones 20 and 20 containing a cutting predetermined zone are formed, and, subsequently the zone is cut by the knife etc. in the cutting predetermined zone 21.

Fig. 7 illustrating the 5th example is the modification of the 1st example shown in Fig. 1.

Although the 1st example has one ridge, a counter jaw 11 has two ridges 111,111 to the operation surface 112 in this 5th example.

Since the 5th example has two ridges, the 3rd accumulation portion (not shown) is formed between the two ridges 111,111.

In this accumulation portion, the seal prevention impurity is mixed with melting/softening thermoplastic material, and the accumulation prevents such seal prevention.

By formation of this 3rd accumulation portion, seal intensity is strengthened, the removal distance of a seal prevention impurity is shortened, and a quicker seal is made possible.

Fig. 8 illustrating the 6th example is the modification of the 2nd example shown in Fig. 4.

Although the 2nd example has a singular cross-sectional chevron-shape, in this 6th example, a counter jaw 11 has two chevron-shapes to the operation surface 112. The 6th example is the same as the 2nd example in general.

Since it has two chevron-shapes, the mixed portion (not shown) of a thermoplastic material is formed between this two chevron-shape.

In this mixed portion, seal prevention impurity is mixed with melting/softening thermoplastic material, and the mixed portion prevents seal prevention.

Like the formation of the 3rd above-mentioned accumulation portion, by the formation of the mixed portion, seal intensity is strengthened, removal/move distance of a seal prevention impurity is shortened, and a quicker seal is made possible.

The following advantages are shown by the seal device and the filling machine of this invention so that clearly from the above-mentioned example.

(1) Even if the packaging material contains the thermoplastic layer polluted by impurities,

the seal performances can have the desired strength and the desired liquid tight.
(2) Even if the packaging materials are sealed under the liquid surface of any liquid food, any seal prevention residual substance can be removed from the surface of the thermoplastic layers, and/or the seal prevention residual substance can be well mixed.
(3) Even if the packaging laminated material is covered with the residual substance of the oxide and the content etc., the bad influence of such a seal prevention impurity can be reduced, and the possible optimum seal be obtained .
(4) In the seal jaw and counter jaw in the packaging system, the main function of a counter jaw is a pressure and the function of a counter jaw has been recognized that the importance of a function is low compared with the seal jaw.
However, the working efficiency and cost performance are optimized by decentralizing a function to a seal jaw and a counter jaw.
(5) Stagnant content liquid is not formed in the seal zone, and contents liquid such as juice does not adhere hygienically to the cross section of a seal zone.
(6) Since the seal jaw has a flat operation surface, the generating high frequency magnetic field is uniform and smooth in heat-healing by the high frequency induction heating with the inductor of the seal jaw.
Moreover, when heat-healing by ultrasonic heating using the horn of a seal jaw, there is no unevenness in a horn surface, uniform heating can be enabled, and the seal which does not have the worn-out crack of a heat-sealing surface, and roughness further can be obtained.

Availability on industry

The heat-sealing device by this invention and its filling machine manufacture the packaging container filled with liquid food, such as milk and a fruits drink, from a packaging material web.